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**LISTENING TO THE FRONTEND****CROSS-REFERENCE TO RELATED APPLICATIONS**

This application claims the benefit of U.S. Provisional Application No. 62/325,589, filed Apr. 21, 2016, and U.S. Provisional Application No. 62/334,796, filed May 11, 2016, which are incorporated herein by reference in their entirety.

**TECHNICAL FIELD**

This invention relates generally to sound analysis and, more specifically, to sound analysis in a shopping facility.

**BACKGROUND**

Many different types of sounds result from people in a shopping facility. For example, guests of the shopping facility may talk amongst each other or with employees of the shopping facility. Additionally, guests and employee movements and activities can generate additional sounds. A need exists for ways to capture the sounds resulting from people in the shopping facility and determine performance of employees based on those sounds.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Disclosed herein are embodiments of systems, apparatuses, and methods pertaining to sound analysis in a shopping facility. This description includes drawings, wherein:

FIG. 1 depicts a shopping facility including sound sensors **102** positioned near a terminal **100**, according to some embodiments.

FIG. 2 depicts a system in a shopping facility including sound sensors **202** that is configured to determine the length of a line at the terminal **200** in a shopping facility based on signal strength, according to some embodiments.

FIG. 3 depicts a system including multiple sound sensors that is configured to determine a length of a line at a terminal **312** in a shopping facility based on trilateration, according to some embodiments.

FIG. 4 depicts a system including a plurality of sound sensors that is configured to determine the length of a line at a terminal **400** in a shopping facility based on angles of received sound, according to some embodiments.

FIG. 5 depicts an example system **500** for capturing and analyzing sounds in a shopping facility, according to some embodiments.

FIG. 6 is a flow diagram depicting example operations for capturing and analyzing sounds in a shopping facility, according to some embodiments.

Elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions and/or relative positioning of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of various embodiments. Also, common but well-understood elements that are useful or necessary in a commercially feasible embodiment are often not depicted in order to facilitate a less obstructed view of these various embodiments. Certain actions and/or steps may be described or depicted in a particular order of occurrence while those skilled in the art will understand that such specificity with respect to sequence is not actually required. The terms and expressions used herein have the ordinary technical meaning as is accorded to such terms and expressions by persons skilled in

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the technical field as set forth above except where different specific meanings have otherwise been set forth herein.

**DETAILED DESCRIPTION**

Generally speaking, pursuant to various embodiments, systems, apparatuses, and methods are provided herein useful for performing sound analysis and determining a performance metric based on the captured sounds. In some embodiments, a system comprises one or more sound sensors distributed throughout at least a portion of a shopping facility and configured to receive at least sounds resulting from activity in the shopping facility and a control circuit. The control circuit is communicatively coupled to the one or more sound sensors. The control circuit is configured to receive, from at least one of the one or more sound sensors, audio data, receive an indication of an employee, correlate the audio data and the indication of the employee, and determine, based at least in part on the audio data and the indication of the employee, a performance metric for the employee.

Employee efficiency and performance can help decrease costs for a shopping facility as well as increase guest satisfaction. Tracking performance metrics for employees to ensure that the employees are performing their jobs efficiently and correctly can aid in achieving these costs savings and increases in guest satisfaction. One way to track performance metrics for employees is the use of a system including sound sensors near point of sale (“POS”) terminals. The system can process audio data received from the sound sensors, correlate the audio data with an employee that is stationed at the terminal, and determine a performance metric for the employee based on the audio data. The sound sensors can capture audio data based on interactions between the employee and the guests, interactions between the guests, and sounds resulting from movement and/or actions of the employees and/or guests.

Audio data captured by the sound sensors can be used to determine a variety of performance metrics. For example, the sound sensors can capture noises (e.g., beeps) produced by a scanner when an employee scans an item and sounds created by bags (e.g., a bagging turnstile, rustling of bags, bags being placed in a cart, etc.). Based on the noises produced by the scanner the system can determine a number of items in the transaction. Based on the sounds created by the bags, the system can determine a number of bags used in the transaction. The system can then determine how many items an employee placed in each bag during the transaction based on this information. As another example, the sound sensors can capture sounds resulting from guests talking while waiting in line at a terminal or any other sounds resulting from the presence of guest (e.g., rustling noises). Based on distances between where the guests are talking and the sound sensors, the length of the line can be determined. Additionally, the sound sensors can capture audio of conversations between guests and an employee stationed at the terminal. The system can process the audio of the conversations to determine whether the employee stationed at the terminal is greeting guests.

FIG. 1 depicts a shopping facility including sound sensors **102** positioned near a terminal **100**, according to some embodiments. The terminal **100** (i.e., a POS terminal) includes a computer **104**, a scanner **106**, and a bagging station **110** including bags **112**. The bagging station **110** of the example terminal **100** depicted in FIG. 1 includes a support on which the bags **112** are hanging. However, embodiments can utilize other types of bagging stations,